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(54) **Method of and apparatus for monitoring a population in a room and for collecting data from television viewers.**

(57) Apparatus for monitoring the population in a room containing a device (112), the apparatus comprises a detector (300) for detecting the entry and exit of people from the room, and a monitor (410) for monitoring the status of the device (112). The monitor includes a prompting circuit (412) responsive to the detector (300) for prompting people in the room to input additional information to the monitor (410) when the detector detects entry or exit from the room.

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## METHOD OF AND APPARATUS FOR MONITORING A POPULATION IN A ROOM AND FOR COLLECTING DATA FROM TELEVISION VIEWERS

This invention relates to methods of an apparatus for monitoring populations in rooms and, separately, to methods of and apparatus for collecting data from television viewers. More particularly, although not so restricted, the present invention relates to such monitoring apparatus where the entry into or exit from a room is monitored.

The prior art is replete with various systems and arrangements for monitoring the use of devices. An example is monitoring the channel tuning habits of television viewers. The earliest such systems merely collected data on site for eventual manual collection as to the television channels viewed and the times of viewing for various panels of viewers in order to determine market share and ratings of various television programs. Later, systems came into being for use with cable television systems with two-way communications over the cable system between a head end and various cable subscribers. In such a system, the television sets were typically interrogated periodically from the central location over the cable, with the channel selection and time information being sent back to the central location and logged for statistical compilation. Such systems have also been used in the past in pay television systems in which billing information was sent over the cable system from a central location to the various subscribers of the pay television system. The prior art also includes such systems in which a memory was provided at the remote location, i.e., at the television receiver, for accumulating data as to the channel being tuned in at the time. The accumulated data was then periodically transmitted over conventional telephone lines from the remote locations to the central location by telephone calls initiated by either the remote stations or the central location.

Systems for remotely accumulating data regarding the habits of television viewers and their qualitative reaction to television programming have today become important from the standpoint of market research. Several prior art systems enable the viewer's preferences to be monitored. For example, the effectiveness of television programming can be monitored by remote control devices used by audience members who may enter their reaction to broadcast programs displayed on their television screens. Such systems are disclosed in US-A-4,107,734 and US-A-4,308,554. In these systems, the information received by the remote control device is inputted to a localised interrogator and later

dumped to a central computer. This apparatus may be used for determining which channel the set is on and viewer reactions to the displayed broadcast over that channel.

Another approach of the prior art has been to use "people meters". With these people meters, each television set is furnished with one or more remote-control devices which are pressed at the start and finish of viewing to record each person's watching patterns. Thus, this system operates effectively as an electronic diary in which the television viewing patterns of each individual are recorded. As the demands for more precise information about the individual viewer's habits and preferences developed, however, such electronic diaries were no longer sufficient.

Advertising agencies, who buy billions of dollars worth of commercial time on the main networks each year, want to know not only the number of homes with television sets tuned to a particular program, but the actual number of people watching a particular show. With that information, and with breakdowns of sex, age and income, advertising agencies will be better able to tell their clients how to reach the viewer they want. As a result, viewer interactive devices such as that disclosed in U.S. Patent Application No. 658,378 to McKenna et al., incorporated herein by reference, have developed. The data gathering system of McKenna for example, utilises an elapsed time clock to generate prompts at predetermined intervals of time, and the viewer may respond to these prompts by inputting the desired information. In operation, the McKenna system flashes a message on a television screen every thirty minutes or so that asks "Who is watching?" The message will not go away until viewers punch in codes on an attached keypad reporting the individuals in the room so that the system can determine the age and sex of everyone in the room. The McKenna system, therefore, automatically provides prompts at periodic intervals to remind people viewing the television set to push the keys if persons have entered or left the vicinity of the television set since the keys were previously pushed, or to confirm that the viewers have not changed. This system has several shortcomings, however, which the present invention seeks to correct. Such shortcomings include:

1. When persons arrive or depart, they may fail to push the appropriate keys, i.e. to immediately enter the required information without waiting to be prompted to do so. This is especially the case with small children. Such a failure obviously reduces the accuracy of data collected.

2. When a prompt automatically occurs, the persons may push the buttons which confirm no change in viewers, despite the fact that persons have actually arrived or departed since the last previous key entries were made. The resulting deficiencies in the received information are commonly handled by computer editing procedures which make certain assumptions about arrivals, departures, or absence of change. Consequently, the entire resulting file of data concerning viewing by people is suspect. In particular, the value of the data is depreciated when its user desires accurate knowledge of the size and composition of the audience that was exposed to a particular advertising message which was aired during a specific 15 or 30 second interval.

3. Since these systems require active and continuous cooperation by members of the household, many households refuse to allow their installation. Others tire of the activity imposed on them and demand that the monitoring equipment be removed. The result may be the injection of what sampling statisticians call "non-response bias", which can be fatal to the usability and acceptance of the overall audience estimates produced by the system. For these reasons, operators of television audience measurement systems offer financial incentives to induce the pre-selected sample households to allow installation of the equipment and to continue its use. The effectiveness of these incentives, however, usually varies inversely with the socio-economic status of the households and with their values and attitudes. Hence, non-response bias may persist, despite the high cost of financial incentives to the system operators. Obtaining and maintaining the cooperation of various types of households (those of single persons, the aged, certain ethnic populations, etc.) is also a continuing problem.

The present invention relates to an improved system and method for monitoring the use of a device. As merely one example, the present invention may be used to monitor the audience to television programs in sample households. The present invention will issue prompts at more appropriate times, such as when the television set is turned on or when persons enter or exit the room. The present invention will also give the exact time of arrivals and departures of television viewers, thereby providing a more accurate record of who is viewing a particular television program at a given time.

Therefore, the present invention seeks to overcome the above-mentioned disadvantages of the prior art by providing improved systems for determining the use of devices. The present invention improves initial and continuing acceptance of such monitoring systems by the pre-selected sample

households which are monitored. Thus the present invention provides the sample households with a positive incentive to permit installation of the system, which is effective regardless of the socio-economic status, values, etc., of the particular pre-selected sample household.

According to one aspect of the present invention, there is provided apparatus for monitoring the population in a room containing a device, said apparatus being characterised by comprising: detecting means for detecting the entry and exit of people from said room; and monitoring means for monitoring the status of said device, said monitoring means including prompting means responsive to said detecting means for prompting people in said room to input additional information to said monitoring means when said detecting means detects entry or exit from said room.

The device may be a video display means.

Said detecting means may include light emitters and photocells arranged on opposite sides of each passage to said room such that, in operation, said photocells receive uninterrupted beams of light from said light emitters, interruption of said beams of light indicating entry or exit from said room.

In one embodiment said light emitters and said photocells are arranged such that two beams of light, parallel to each other, cross each passage to said room at a first height, said beams of light at said first height being, in operation, interrupted by the entry or exit of a small child or an adult from said room, and another two beams of light, parallel to each other, cross each passage to said room at a second height, said second height chosen such that said beams of light at said second height are not, in operation, interrupted by the entry or exit of a small child from said room, and said prompting means being arranged to be actuated only when all of said beams are interrupted.

As a result, the audience monitoring system of the present invention can identify the passage of children without generating a prompt on the television screen. This is useful because small children are considered to be part of the same audience demographic category for statistical purposes, thus no additional information needs to be provided.

Said detecting means may be arranged to generate a gain signal when a person enters said room and generates a loss signal when a person exits said room.

Said detecting means may include timing means which is activated when at least one of said beams of light is interrupted, said timing means remaining activated until the beams of light are no longer interrupted or until a predetermined interval of time has passed, whichever first occurs, said timing means, in operation, producing a unique

code when said predetermined interval has passed and the beams of light are still interrupted, said unique code indicating that a door across the passage to said room is closed.

Said monitoring means may consist of a distributed monitoring system (Figure 10) for a house for monitoring the status of one or more television receivers in said house and monitoring with one or more of said detecting means the entry and exit of people from the rooms in said house.

In accordance with a further embodiment of the present invention, the functions of the television monitoring devices, and the information they detect are controlled by, reported to, and stored in a single device called a household collector. The household collector unit will collect, time stamp, log, and transfer to a remote host computer all the information gathered by those monitors installed on its local network. The HUB may also be described as a gateway or protocol converter between the household metering network and the telephone network connecting the monitoring system to the host computer system. In the present invention, the HUB will process and store the data received from each television monitor and the information received from each motion detection device.

According to another aspect of the present invention there is provided apparatus for collecting data from television viewers, including a plurality of remote units at a plurality of viewer locations, each of said remote units monitoring the population in a room containing a television receiver and characterised by comprising: detecting means for detecting the entry and exit of people from said room, said detecting means including light emitters and photocells arranged on opposite sides of each passage to said room such that said photocells, in operation, receive uninterrupted beams of light from said light emitters, the interruption of said beams of light by a person entering said room causing a gain signal to be generated, and the interruption of said beams of light by a person exiting said room causing a loss signal to be generated; and video monitoring means for monitoring the status of said television receiver, said video monitoring means including prompting means responsive to said gain signal or said loss signal for generating a prompt requesting a user to input data including the identification of people in said room to said video monitoring means, said video monitoring means further comprising processing means, responsive to said gain signal or said loss signal, for sending an enable signal to said means for generating a prompt, and memory means controlled by said processing means, for storing the time of day, said gain signal or said loss signal, and data representing the status of said television

receiver, said memory means providing said gain signal or said loss signal to said means for generating a prompt when said processing means sends said enable signal.

According to a further aspect of the present invention there is provided a method of monitoring the population in a room containing a device, characterised by comprising the steps of: monitoring the status of said device; detecting the entry and exit of people from said room; and prompting people in said room to provide additional information when said detecting step detects entry or exit from said room.

According to a yet further aspect of the present invention there is provided a method of collecting data from selected television viewers, said data including the identification of people in each room containing a television receiver characterised by comprising the steps of: detecting the entry and exit of people from each of said rooms with light emitters and photocells arranged on opposite sides of each passage to each of said rooms such that said photocells receive uninterrupted beams of light from said light emitters; generating a gain signal when at least one of said beams of light is interrupted by a person entering each of said rooms; generating a loss signal when at least one of said beams of light is interrupted by a person exiting each of said rooms; monitoring the status of said television receiver and receiving said gain signal and said loss signal; storing the time of day, said gain signal or said loss signal, and data representing the status of said television receiver; and generating a prompt requesting a user to input data including the identification of people in each of said rooms to said video monitoring means in response to said gain signal or said loss signal.

According to yet another aspect of the present invention there is provided a method of monitoring the population in each room containing a television receiver in a house, said house equipped with a distributed monitoring system for monitoring the status of at least one of said television receivers in said house and for monitoring the motion of people to or from each room containing a television receiver, characterised by comprising the steps of: detecting the entry and exit of people from each room containing a television receiver, with light emitters and photocells arranged on opposite sides of each passage to each of said rooms such that said photocells receive uninterrupted beams of light from said light emitters; generating a gain signal when at least one of said beams of light is interrupted by a person entering said room; generating a loss signal when at least one of said beams of light is interrupted by a person exiting said room; transmitting said gain signal or said loss signal at periodic intervals; storing said gain signal

or said loss signal transmitted in said transmitting step; determining if an alarm means is activated; initiating an alarm if said alarm means is activated and said gain signal or said loss signal has been received; determining if a gain signal and a loss signal or a loss signal and a gain signal were received from one of said rooms in rapid succession when said alarm means was not activated; for each television receiver in said house, determining if said television receiver is activated; determining if said detecting steps detects an adult or a child; and generating a prompt on said television receiver when the entry or exit or any adult from the room containing said television is detected, said television receiver is determined to be activated and said signals are not determined as being generated in rapid succession, said prompt requesting that data representing the population of people in the room be inputted.

According to an additional aspect of the present invention there is provided a method of monitoring the population in each of a plurality of rooms containing a video display means, characterised by comprising the steps of: a) detecting the entry and exit of people from each of said rooms; b) monitoring the status of at least one of said video display means; c) monitoring said detecting step a) and said status monitoring step b) from a central location in said house; and d) generating, in response to said monitoring step c) determining that at least one of entry and exit has occurred in one of said rooms with said video display means activated, a prompt for said video display means in said one of said rooms.

Acceptance of the present invention should be improved, for prompts are required in only two situations: when the television set is initially turned on, or when there is any increase or decrease in the number of persons in the room where the television set is located. This eliminates the annoyance to viewers caused by present systems which issue prompts at periodic or random intervals, thereby requiring responses even though no change in viewers may have occurred. Consequently, initial and continuing acceptance of the system by the pre-selected sample households will be improved by the present invention.

As a further incentive for the acceptance of the present invention in sample households, the motion detectors may be electrically connected to an audible alarm which is activated by the user. When motion is detected anywhere in the household, the alarm will sound until it is switched off. If desired by the members of the household, an auto-dialer can also be installed so that the household's telephone line can be used to report possible intrusions to the public authorities or to commercial intrusion detection services.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:-

Figure 1 schematically illustrates possible locations for devices of an apparatus according to the present invention when installed in a sample dwelling unit;

Figure 2 schematically illustrates the installation of a motion detector on a passage between rooms;

Figure 3 is a block diagram and partial - schematic diagram illustrating an exemplary embodiment of a motion detector of an apparatus according to the present invention;

Figure 4 is a block diagram of apparatus utilised in an apparatus according to the present invention for transmitting the output of a motion detector to a television monitor;

Figure 5 is an embodiment of a prompt generator which may be used with an apparatus according to the present invention;

Figure 6 is a detailed block diagram of an embodiment of a data collection unit of an apparatus according to the present invention;

Figure 7 is a block diagram and partial - schematic diagram of an embodiment of an apparatus according to the present invention appropriate for dwelling units in which small children reside;

Figure 8 is a block diagram and partial - schematic diagram of a further embodiment of an apparatus according to the present invention appropriate for passages fitted with doors;

Figure 9 is a block diagram and partial - schematic diagram of yet another embodiment of a motion detector of an apparatus according to the present invention appropriate for use with a household collector;

Figure 10 shows an exemplary embodiment of a household collector (HUB) used in another embodiment of an apparatus according to the present invention; and

Figure 11 is a logic flow diagram relating to an audience monitoring system using the household collector shown in Figure 10.

Although the preferred embodiment will be described below with respect to a television monitoring system, the present invention may be employed to monitor the use of many other devices.

A preferred embodiment of apparatus according to the present invention, to be described below, relates to a data gathering system for television which includes a plurality of remote units which are controlled from a central location. Each of the remote units is attached to a television receiver which may be, but is not necessarily, attached to a cable system. Each of the remote units functions to determine television channel selection data and receive data from motion detectors in accordance

with the present invention. This data is stored for later transmission to a central data collecting point. A more detailed description of such an overall system is provided in U.S. Patent Application No. 658,378 referred to above.

An exemplary embodiment of the present invention includes a data gathering system such as that of U.S. Patent Application No. 658,378 which has been modified to receive data from a motion detection device in accordance with the present invention. The system is designed such that whenever motion is detected by the motion detection device, activity of the monitoring apparatus is interrupted, and a prompt is generated for the persons who may be near the television receiver. An example of the implementation of such a system in a sample household will be provided with respect to Figure 1.

Figure 1 illustrates a dwelling unit which contains a kitchen (K), a dining room (DR), a bathroom (B), a master bedroom (MBR), two other bedrooms (BR2, BR3), and a living room (LR) which have been equipped with the audience monitoring apparatus according to the present invention. Passages between the rooms are designated with numerals 100 or 102, with the passages designated as 100 located between one room containing a television monitoring device and a room without such a device and with the passage designated as 102 located between rooms which both include a television monitoring device. The outside entry into the dwelling unit is designated as 104. A manual switch near the entry used for operating an alarm is designated as 106, and the audible outside alarm is designated as 108. At his option, the resident of the dwelling unit equipped with the monitoring apparatus according to the present invention may also have a telephone auto-dialer 110 installed in any convenient location near a power outlet and a telephone terminal box (shown in Figure 1 in the master bedroom). Reference 112 is used to designate a television receiver equipped with a monitoring device. For the purposes of Figure 1, it is assumed that a television set and monitor may be placed in any of the rooms other than the bathroom and that the living room may contain more than one television set and monitor. Consequently, a motion detection device is installed at all passages designated 100, 102 and 104, but not at the passage to the bathroom.

Figure 2 illustrates the installation of a motion detector on a passage into or between rooms X and Y. The opposing faces of the passage (the door jambs or walls) are designated 200 and 202. Affixed to one side of the passage are two light emitters 204 and 206. These light emitters are closely focused to be received separately and discretely by photocells 210 and 208, respectively,

which are fixed in the same relative positions on the opposing sides of the passage. More than one set of emitters and photocells may be affixed at different heights on the opposing sides of the passage (as shown by emitters 204' and 206' and photocells 208' and 210'). This feature will be discussed in more detail below with reference to Figure 7.

The light emitters 204 and 206 and photocells 208 and 210 are arranged such that two beams of light, parallel to each other, cross the passage at a height such that the beams of light are interrupted by the passage of a person through the passageway. Two beams of light are used to determine the direction of the motion through the passageway. For example, if a person moves through the passageway from room X toward room Y, the light beam between emitter 204 and photocell 210 will be interrupted before the interruption of the beam between emitter 206 and photocell 208. The reverse would be true if the person moves through the passage from room Y toward room X. The detected direction of motion will cause an audience increase or an audience decrease signal to be generated, as will be discussed in more detail below with reference to Figure 3.

Referring to Figure 3, there is shown an exemplary embodiment of a motion detector 300 of an apparatus according to the present invention. The motion detector 300 may be placed at each passageway of a dwelling unit as shown by 102 in Figure 1. (A detector of the type for a passage designated 100 or 104 is not shown since it is the same except that only one signal emitter is needed). Light emitters 204, 206 and photocells 208, 210 correspond to those shown in Figure 2. In addition, to reduce the precision of the focusing required between the light emitters and the photocells, it may be desirable to radiate the two light beams at different frequencies. Oscillators 301, 302 have been added for this purpose, and a pair of filters 303, 304 have also been added between the photocells 208, 210 and the circuits which they drive. The filters 303, 304 pass a high level signal from the photocells 208, 210 when the light beams are continuous, in other words, when no motion has been detected. When one of the beams has been interrupted, however, the output of the corresponding photocell through the filter changes to a low state.

For the purposes of illustration, it will be assumed that the beam of light between the light emitter 204 and the photocell 210 was interrupted before the light beam between the light emitter 206 and the photocell 208. As a result, the falling edge of the output of the filter 303 triggers a one-shot 305 which has Q and  $\bar{Q}$  outputs. The one-shot 305 generates an output pulse with a duration

greater than the length of time required by a person to traverse the distance between the first light beam and the second light beam. Before the light beam has been interrupted, one-shots 305,306 have Q outputs which are in the low state and  $\bar{Q}$  outputs which are in the high state. The  $\bar{Q}$  output of the one-shot 305 is connected to the clear input C (which may be an enable input) of the one-shot 306, and the  $\bar{Q}$  output of the one-shot 306 is connected to the clear (or enable) input C of the one-shot 305. As a result of this interconnection, only a single one-shot can be active at any given time.

Consequently, when the rising edge of the output of the filter 303 is received by the one-shot 305, a pulse of a predetermined duration is outputted, thereby changing the Q output to a high state and the  $\bar{Q}$  output of the one-shot 305 to a low state disabling the one-shot 306. Therefore, when the second light beam is broken and a rising edge is received by the one-shot 306, no pulse will be outputted. In this manner, only one pulse output will be generated for each movement through the passageway.

The Q outputs of the one-shots 305,306 are then inputted into a switching network 310 comprised of FET transistors 311,313,312,314. The output of the one-shot 305 is connected to the gate of FET transistors 311,313, and the output of the one-shot 306 is connected to the gate of FET transistors 312,314. These FET transistors function as switches, for when a high input is received at the gate, conduction occurs between the source and the drain. The source of the FET transistors 311,314 are connected to a code generator 316, which generates a loss signal indicating that the audience has decreased. In other words, the output of the code generator 316 is used to indicate that a viewer has left the room. Similarly, a code generator 318 is connected to the source of the FET transistors 312,313. The code generator 318 generates a gain signal indicating that the audience has increased, i.e. that a person has entered the room. The drains of the FET transistors 311,312 are connected to a transmitter 322 for room Y, and the drains of the FET transistors 313,314 are connected to a transmitter 320 for room X. Consequently, in the example given, when the FET transistors 311,313 conduct, the code generator 316 sends a loss signal to the transmitter 322, and the code generator 318 sends a gain signal to the transmitter 320. The converse is true when the FET transistors 312,314 conduct as a result of the output of the one-shot 306.

The output of the one-shots 305,306 are also connected to the input of an OR gate 324, whose output is connected to a one-shot 326. Thus, when either beam has been interrupted, the one-shot 326

will generate an output pulse signal which enables the transmitters 320,322 and an alarm transmitter 328. In the above example, the transmitter 320 will then output the gain signal on a line 45X and send it to a monitor in room X. Similarly, the transmitter 322 will output the loss signal on a line 45Y and send it to a monitor in room Y. The reverse is true when the beam to the photocell 210 was the first to be interrupted; the gain code would be sent to room Y and the loss code to room X. When the photocells 208,210 are located in a passageway between a room in which a television set and monitor may be placed and an area such as the bath, hallway, or outside entry (designated by 100 or 104 in Figure 1) the output of one of the transmitters 320,322 is not used.

As noted above, the output of the one-shot 326 may also be connected to the alarm transmitter 328. The alarm code transmitter 328 sends a code over the household power main to the manual switch 106 shown in Figure 1. Alternatively, transmitter 328 can also generate a low power over the air radio signal to a receiver in front of the manual switch 106. If the user has activated the manual switch 106, the outside alarm 108 is activated. Optionally, the telephone auto-dialer 110 may also be installed in any convenient location near a power outlet and telephone terminal box.

In situations where it is not feasible to run a wire from one side of the passage to the other, the light emitters 204,206 can be powered by a separate transformer served by a power outlet on their side of the passage. Alternatively, each motion detector 300 may be battery operated.

Figure 4 is a block diagram of a television monitoring device of an apparatus according to the present invention. A receiver 402 receives as an input either the output of the transmitter 320 or the output of the transmitter 322, depending upon which room the receiver is in. The receiver 402 may also receive the gain or loss codes from other motion detectors in the same room. The receiver 402 may contain, for example, a buffer memory for storing the gain or the loss signal. For distinguishing receivers in adjacent rooms, the receiver output may be modulated on different frequencies for the transmitters in room X and room Y, respectively.

When there has been motion into or out of the room, the gain or loss code from the receiver 402 is flashed by an infrared radiating LED 404. The signal is received by an infrared detection diode 406, which is mounted on a television set monitoring device, and is grounded through a capacitor 408. The energy picked up by the diode 406 is transferred to a monitoring device 410. The monitoring device 410 may be of the type disclosed in U.S. Patent Application No. 658,378. As in this prior system, the monitoring device 410 comprises a



microprocessor 412 and a memory unit 414. The energy received by the diode 406 is next transferred to prompting logic in the microprocessor 412, which then logs the gain or loss code and the time of day into the memory 414. The microprocessor 412 generates an overlay enable signal which is received by a prompting generator (discussed in detail below with reference to Figure 5). The microprocessor then determines if a gain or a loss code was received and sends the appropriate address for the gain or loss prompt to the prompting generator. The prompting generator then generates a gain or a loss prompt on the television screen. The prompt will remind the person or persons in the room to push the keys of an input device 416 to indicate which persons have newly entered or exited the room. Information received from the input device 416 is then sent over a data line to the prompting generator, displayed on the television screen, and stored in the memory 414.

The microprocessor 412 may be programed to execute firmware commands which prevent a prompt in cases where a gain and a loss (or a loss and a gain) signal occur in rapid succession. Thus, when a person passes through a room without significant pause or momentarily leaves the room, no prompt will be generated. In order to implement such a feature, the received gain signal or loss signal is stored in temporary storage until a predetermined interval of time has passed. The predetermined interval of time may be on the order of several seconds, and during that time the microprocessor will wait for a signal indicating reverse movement through any of the passageways. If an indication of reverse movement is not received in the predetermined time interval, the microprocessor 412 will send an overlay enable signal to the prompting generator. The information stored in the temporary storage portion of the memory 414 will then be placed in a primary memory portion such that a log of entry and exit may be kept. In addition, a prompt may not be desired when a door across a passageway to the room is closed. Such an embodiment is discussed in more detail below with reference to Figure 8.

It should be noted that the gain or loss signal transmitted by the LED 404 is only picked up if a television and a monitoring device in a room adjacent the passage are activated. Thus each television monitor responds to the circuitry in that room only. Consequently, a prompt is generated only when the television and television monitoring device are both activated. In addition, some television sets are permanently located in a particular room, therefore, the receiver 402 would be part of the

television set monitoring assembly, with the lines 45X or 45Y connected directly to it. In this situation, elements 402,404,406,408 would not be needed.

Referring to Figure 5, a prompting generator which may be used with an apparatus according to the present invention is illustrated. A particular embodiment of this prompt generator is disclosed in U.S. Patent Application No. 658378. Obviously, apparatus according to the present invention may be employed with any other of the well known prompting systems with only minor changes well within the level of skill in the art. The prompting generator of U.S. Patent Application No. 658378, as one example, generates a gain or a loss prompt depending upon the data and address signals received from the microprocessor 412.

A video generator 504 reads the contents of a RAM 502 and produces a video output. The RAM 502 stores video data which is read as lines of 8 bit ASCII characters. This video data may represent a series of prompt signals which request information from the viewer such as the identification of people viewing the television, their sex, their age and the like. The output of the video generator 504 is passed through an RF modulator 506 which is, in effect, a small television transmitter that sends a picture displaying the characters stored in the RAM 502. The carrier frequency for this signal is fixed to be identical to that of the output of a cable converter, which is usually channel 3.

A cable converter converts all incoming television signals to a single output channel, for example, channel 3. A small receiver 512 is used to demodulate this RF signal and extract the vertical sync pulse. This pulse is fed into a synchroniser circuit 514, which starts the RF modulator 506 and the video generator 504. The RF signal from the RF modulator 506 is presented to a switch 510. The switch 510 is a suitable electronic switch for high speed switching of an RF signal. This switch selects the RF signal from either the cable converter or the RF modulator 506 and directs the selected signal to the television receiver.

The switch 510 is controlled by a switch control circuit 508. This switch control circuit 508 detects the border that appears around the area on the television screen where the text is written. The signal level change that occurs at the left edge of a screen of text is a trigger causing the switch control circuit 508 to set the switch 510 to select the output of the RF modulator 506. The switch control circuit can also detect the transfer of a byte of data in which all the bits are set (i.e. hexadecimal FF) from the RAM 502 to the video generator 504. The detection of a data byte with all bits set causes the switch control circuit 508 to reset the switch 510 to select the converter output.



The text can appear anywhere on the television screen. Each line of text is displayed until the end of the line or until a byte containing hexadecimal FF is read from the RAM 502. If a text line is not to be displayed, the byte corresponding to the first character of that line is set to hexadecimal FF. Full lines or portions of lines can be switched. The overall effect is that of lines of characters being displayed over the picture from the cable converter.

The microprocessor 412 controls this display via the RAM 502 and an overlay enable line 516. The microprocessor 412 first addresses the RAM 502 to retrieve the characters representing the gain prompt or the loss prompt to be displayed and bytes of hexadecimal FF to define areas of the screen that are to remain unaffected. Characters received from the user input are also retrieved. When the microprocessor 412 sets the overlay enable line 516, the text is displayed over the normal picture. The overlaid text is removed when the microprocessor 412 clears the overlay enable line, which occurs after all input is received from the user.

It should also be noted that other forms of prompting generator may be used to request input from the television viewer. For instance, the prompt could be a light on a box or an audible buzzer. In addition, the prompt could take the form of a spoken reminder from a synthesised voice unit. Other devices may be used; however, each such device must effectively remind the viewer to input information to update the status of the audience composition after the detected movement.

In accordance with an embodiment of the present invention, a gain prompt or a viewer identification prompt is first issued when the television set is turned on. Subsequent prompts are issued when gain signals or loss signals are generated by the motion detectors as discussed with reference to Figure 3. Each gain signal, each loss signal, and the information inputted by the user is recorded in the monitor's memory for subsequent transmission to a host computer system in accordance with the methods disclosed in U.S. Patent Application No. 658378. In this manner, a complete account of the audience composition is recorded on a current basis for all of the television programming viewed by members of the sample household. The present invention thus allows more accurate records to be kept since the comings and goings of each viewer of a particular television show can be monitored.

Referring now to Figure 6, there is shown a functional block diagram of a data collection unit for use with an apparatus according to the present invention. The data collection unit is operated by a microprocessor 37 which receives suitable programming contained in a ROM 38. A RAM 39 is

provided for storing event information such as channel selection, television mode selection, and the identity of the viewers who are present. A clock 40 is also provided to run the microprocessor 37, with the clock 40 also functioning to maintain a time of day indication for recording times in connection with events stored in the RAM 39. The RAM 39 typically is provided with 32K bytes of storage, but more may be provided to implement the present invention.

The television monitoring device 410, discussed in Figure 4 above, may be easily integrated into the system of U.S. Patent Application No. 658378. For example, the microprocessor 37 disclosed in this prior U.S. Patent Application could be modified to perform the functions of the microprocessor 412, and the RAM 39 of U.S. Patent Application No. 658378 could include further memory for storing the gain and loss codes as discussed above with reference to Figure 4. The ROM 38 of U.S. Patent Application No. 658378 could also store additional programming data for processing the gain or loss codes.

As shown in Figure 6, the arrangement disclosed in U.S. Application No. 658378 can be modified to include a further interface, namely the motion detector 300. The data received from the motion detector 300 could then be processed and stored in a manner similar to that provided for event information such as channel selection and television mode selection. In addition, the outputs of each motion detector in a room could be inputted into a slave data collection unit placed in that room, with each data collection unit operating in the manner disclosed above with reference to Figures 4 and 5. The information gathered by each of the slave data collection units may then be collected by a master data collection unit. The master data collection unit, for example, can poll each of the slave data collection units by carrier current over low voltage telephone wiring to collect the available data at each of the slave data collection units, addressing each of these slave data collection units in series by code as necessary. Thus, all of the data from all of the various data collection units within a household will be stored in a master data collection unit. The information stored in the master data collection unit can then be transferred through a telephone block interface 22 to the host computer system. A further embodiment of a master data collection unit which can be used with apparatus according to the present invention is discussed below with reference to Figure 10. Other features of the elements shown in Figure 6 are described in more detail with reference to Figure 5 in the U.S. Patent Application No. 658378.

Figure 7 is a diagram showing an embodiment of apparatus according to the present invention appropriate for a household including small children.

Components 204,206,301,302,208,210,303,304,305,306 are duplicated, with one set of emitters and photocells installed in the passage at a height that would be interrupted only by an adult and a second set (indicated by the same numbers with a prime) installed at a height that would be broken by both an adult and a child. The oscillators 301,302 may operate at different frequencies than the oscillators 301',302' for the higher and lower beams, respectively. Other elements operate in the same manner described above with reference to Figure 3. The higher and lower beams from corresponding sides of the passageway (adjacent room X, for example) are respectively inputted into OR gates 702,704. Whenever either or both of these beams are interrupted by movement through the passage, a pulse is generated in the same manner as described with reference to Figure 3. In the present embodiment, however, the outputs of each one-shot is used as an input into code generators 316',318'. These inputs enable the code generators 316',318' to determine whether the movement through the passageway was that of an adult or a child. An adult code would be generated when beams from light emitters 204,204' or 206,206' are interrupted at approximately the same time, whereas a child code would be generated when only beams from the light emitters 204' or 206' are interrupted.

By way of example, if the beam received by photocell 210' was interrupted by movement through the passageway, one-shot 305' would generate a pulse indicating movement has been detected in the passageway. One-shot 306' would be disabled, and the outputs of one-shots 305,306 would remain the same since the higher beams were not interrupted. The code generators 316',318' would then generate a code indicating that a child has passed through the passageway, and in the given example, the output of the loss code generator 316' would be connected to the transmitter 320 for room X, and the output of the gain code generator 318' would be connected to the transmitter 322 for room Y. Such is the case because the OR gate 702 would output a high signal, activating the FET transistors 311,313. In addition, an OR gate 324' is connected to the output of each of the one-shots such that a transmit pulse is outputted by the one-shot 326 only when motion has been detected by one or more of the motion detectors. Similarly, the code generators 316',318' will send a code indicating that an adult has moved through the passageway whenever the higher beam and the lower beam on the same side of the passageway are approximately simultaneously interrupted. In addition,

the prompting logic of the microprocessor 412 would be modified to suppress all prompts in cases in which the gain or loss code is for children, but the children's gain or loss code will be stored in the memory 414 so that their viewing habits may be monitored as well.

Figure 8 is a block diagram and partial schematic diagram showing a further modification of the motion detector of Figure 3, which may be appropriate for passages that are fitted with doors. Like components are indicated by the same numerals used in Figure 3. When a beam is interrupted, a counter 802 is activated. In its resting state, the counter 802 has an overflow bit which is in the low state. The overflow output is connected to an inverted input of an AND gate 804, which receives as its second inverted input the output of the filter 303. Whenever the light beam is interrupted, the output of the filter 303 changes to a low state, thus causing the AND gate 804 to generate a high output. The rising edge of the output of the AND gate 804 clears the counter 802, and the high output of the AND gate 804 enables the counter 802 to begin counting. The counter 802 continues to count until either the overflow bit changes to a high state or the output of the filter 303 changes to a high state, thereby indicating that the beam is no longer interrupted. The number of counts needed before the counter 802 reaches the overflow state is determined by the length of time considered appropriate before generating a closed door signal. Twenty seconds, thirty seconds, or any other desirable length of time may be chosen. When the beam has been interrupted longer than this predetermined interval of time, the overflow bit changes to a high state, thereby disabling the counter. The overflow bit is received by code generators 316'',318'', and a unique code is produced indicating that the door is closed. The overflow bit is also connected to one input of an OR gate 806, which outputs a signal activating the switching network 310. The output of the code generators 316'',318'' are thus connected to the transmitters 320,322.

The high overflow bit is provided through the gate 806 and gate 324'' to the one-shot 326 so that a transmit signal is produced. This causes a special code which indicates that the door has been closed to be transmitted to the monitoring device in rooms X and Y. If the closed door code is sensed by the microprocessor 412 later than a predetermined interval after a gain or loss code has been sensed, the microprocessor logic concludes that the beam across the passage has been interrupted by the closing of the door rather than the movement of a person. In this situation, no prompt is displayed. It should be noted that if a person enters or leaves the room and then closes the door be-

hind him that a gain code or a loss code will be generated and then a closed door code will be generated. The gain code or the loss code will cause a prompt to be generated, but the closed door code will not.

Referring now to Figure 9, a modified portion of the motion detector of Figure 3 is shown. In the Figure 9 embodiment, the transmitters 320,322 are replaced by buffer memories 920,922, respectively. The buffer memories 920,922 store the gain or loss codes generated in the normal manner. The buffer memories may be interrogated by the microprocessor or a household collector (HUB) which is discussed in more detail with reference to Figure 10. A destructive read is performed at recurring intervals in the microprocessor's program. In the previously described embodiments of the motion detector, the motion detector automatically interrupts the functioning of the microprocessor; however, in the Figure 9 embodiment, the microprocessor's programming contains a routine for periodically checking the status of the motion detector. A flow diagram for such a program is discussed in more detail below with reference to Figure 11.

In some television monitoring devices, there is little or no logical capability or storage in a monitoring device attached to the television set. Instead, the functions of the monitoring devices, and the information they detect, are controlled by, reported to, and stored in a single device sometimes called a household collector. The household collector communicates over the household main, over specially installed hardwires, or over an RF channel with all the monitoring devices. In such systems, each monitoring device has a unique identification code, and each monitoring device reports to the household collector when interrogated. When the present invention is used with such systems, simplifications can be made in the invention, with corresponding functions being programed into the microprocessor of the household collector. A household collector for use with apparatus according to the present invention is shown with reference to Figure 10.

Figure 10 shows a distributed monitoring system in which each motion detector is treated as a separate doorway meter. Each doorway meter reports to a household collector (HUB) as to direction and whether the motion was by an adult or a child. Each doorway meter will have a small amount of buffer memory and may be polled as discussed above with reference to Figure 9. In a microprocessor of the household collector, each doorway meter is treated as a separate task, and prompts are generated by the appropriate monitoring devices upon the direction of the household collector.

The household collector is connected over a telephone network 1012 to a host computer system 1014 in the manner disclosed by U.S. Patent Application No. 658378. The household collector reports the status of the doorway meters, each television monitoring device within the household, and auxiliary devices. In the specific embodiment shown in Figure 10, the household collector is shown controlling a television meter 1020 and a television meter 1030. Each of these television monitoring devices may generate a prompt on televisions 102',103', respectively, and viewers may respond to those prompts by utilizing user input devices 1022,1032, respectively. In addition, the household collector may monitor such auxiliary devices as a VCR meter 1040, which monitors the use of a VCR 1042, and a cable meter monitor 1050 with user input device 1051, which monitors the usage of a cable television set 1052.

In accordance with the present invention, the household collector monitors each doorway meter in the household. The household collector is connected to each doorway meter by a 2-way communication path over an RF channel. When a dwelling unit is equipped with a household collector, the receiver 402 as shown in Figure 4 is replaced by a transceiver 1002 as shown in Figure 10. The transceiver 1002 receives a buffer read signal from the household collector which is sent to the buffer memories 920,922. The gain or loss code is then transmitted back to the household collector. Each transceiver will be equipped with a code so that each individual doorway meter can be identified by the household collector. This additional information is attached to the gain or loss code generated by the motion detection device of the present invention and stored in a memory of the household collector. In addition, each monitoring device will have its own unique code so that it can be identified by the household collector. The household collector then transmits the gain or loss code to the appropriate television meter so that a prompt can be generated on the screen of the television sets in the room or rooms where motion was detected. Finally, the household collector unit will collect, time stamp, log, and transfer to the remote host that information gathered by those meters installed on its local network.

In the exemplary embodiment of apparatus according to the present invention, the household collector is in a star configuration, with the household collector as the master. The household collector will poll the television meters one at a time, expecting a response from each poll message. Meters may be polled as often as once per second, with some types of meters being polled less frequently. In addition, the household collector may establish an electronic mailbox for each meter, with

a separate process defined for each meter, and at each meter, simple flags will be used to indicate the existence of valid data. Each message in either direction on the network will contain the meter address, a command byte specifying the type of message, the message sequence, and the desired data. For example, the household collector may send commands such as: "no data for you, send now if you have any" or "here's data for you, send data if you have any". Each monitoring unit may also send commands such as: "message received - no data from meter" or "message received - here's my data". All message traffic is initiated by the household collector by sending a single message packet that is addressed to a specific meter. Response is always expected from the meter and no meter can transmit except when specifically addressed by the household collector. The household collector may also use three different media for communication with its peripheral monitoring devices. These are hard wired, carrier current using the household main, and RF. The household carrier may have interface slots for all three of the communication links as shown in Figure 10. In this manner, the household collector may communicate with each monitoring device and each auxiliary monitoring device over a 2-way communication channel, and the household collector may communicate over a separate 2-way communication channel with the doorway meters.

As noted above, the household collector operates by polling each individual device on its communication network. Thus the household collector may interrogate television monitoring device 1020, then interrogate television monitoring device 1030, then interrogate the auxiliary VCR meter 1040 and cable meter 1050, and then interrogate each doorway meter. Thus in the microprocessor, each monitoring device and each doorway meter can be treated as a separate software task. An example of a doorway task will be described with reference to Figure 11.

Figure 11 shows a logic flow diagram for a doorway task utilised by the microprocessor for each doorway meter. The microprocessor of the household collector calls up a doorway task stored in its memory unit and performs it for each meter in the house (step 1100). The microprocessor generates a polling signal which passes through an RF interface to the desired transceiver unit 1002. The read signal 902 is then transmitted to the buffer memory units 920 and 922. The buffer memory units are read and their outputs are transmitted back over lines 45X or 45Y to transceiver 1002. Upon receipt of this information, the transceiver 1002 transmits the gain or loss code to the RF interface, and the doorway information is placed in the memory of the household collector (step 1102).

The received signal is then checked to see if a valid code was received (step 1104). If no gain or loss signal or a special code signal was received, the doorway task for that meter is exited. If a gain or a loss signal was received, however, the microprocessor knows that movement in the doorway has been detected. When such movement in the doorway has been detected, the microprocessor then determines if the user has turned on an alarm circuit (step 1106). If the alarm circuit is on, the microprocessor will send an output signal to the alarm transmitter 328 over the household main (step 1108). The microprocessor will then return to the next step in the doorway program. When the alarm circuit is off or after the alarm procedures have been initiated, the microprocessor will wait a predetermined interval of time after receiving the doorway status before the microprocessor will generate a signal indicating that motion has been detected (step 1110). In other words, if a gain signal and a loss signal or a loss signal and a gain signal have been received from the buffer memory, the microprocessor will not update the files to indicate that motion has occurred, and the doorway task for that meter is exited. On the other hand, if no doorway movement occurred within the prescribed time (no subsequent gain or loss signal was received in the predetermined interval), the doorway files of the household collector are updated (step 1112).

After determining whether motion has been detected, the microprocessor then checks for each television in a room adjacent to the motion detector (step 1114) whether the television and television monitoring device are on (step 1118). If the television and television monitoring device are off, the microprocessor will then poll the next television meter. For each television that is on, the microprocessor will then determine whether the received signal was a gain signal or a loss signal (step 1120). Then for households equipped with motion detectors which distinguish children (Figure 7), the microprocessor determines whether the movement was that of an adult or a child (step 1122). If the movement was that of a child, the microprocessor will update the status of each monitoring device to indicate that a child has entered or exited the room but no prompt will be generated (step 1126). However, if the received code indicates that the movement was that of an adult, the microprocessor will update the status of the television monitoring device to indicate that an adult has entered or exited the room, and an overlay enable signal will be generated so that a prompt will appear on the television screen (step 1124). The user for that particular television will respond to the prompt, and the status of that monitoring device will be updated (step 1126). This process will continue for each

television and television monitoring device adjacent the passageway containing the polled doorway meter, and the program will continue for each doorway meter in the dwelling unit. The household collector continually polls all of the monitoring devices, and its memory stores all the information received from the monitoring devices and the doorway meters. This information is later transmitted over the telephone network 1012 to the host computer system 1014 in the manner disclosed in U.S. Patent Application No. 658378.

Only one particular design of household collector has been described in detail above. Of course, it will be appreciated that the present invention could be used with many alternative designs of household collector.

Each television device which is monitored by the household collector may also include a code which identifies that particular television. Consequently, when a television is moved from room to room within the dwelling unit, the household collector will be able to keep track of which room the television is in if the user inputs to the household collector which room the television was moved to. The user could do this by setting a manual room identification code selector whenever the television is moved to a different room. The change in the setting of this selector alters the unique code for the relocated monitoring device, which controls its communication with the household collector, thereby informing the household collector the room in which a television set and monitor is currently located. However, use of this approach is likely to result in erroneous results if the panel member fails to set the manual selector correctly or in a timely fashion.

In another embodiment of apparatus according to the present invention using a household collector, a monitoring device may be used to pick up the code from each doorway meter as in the Figure 3 embodiment and store it in its memory. The household collector could then poll each monitoring device for data received from each of the doorway meters and data received by the monitoring devices. The household collector would then store the received code and the time and transmit proper instructions to each monitoring device for the display of a prompt if necessary.

Further simplifications are feasible in households meeting certain conditions, such as households having only one television set to be monitored or in which none of the several television sets is moved from room to room. In such dwelling units, transmitters 320,322,328 can be reduced to a single transmitter which produces a unique code indicating its passage location and which communicates this code along with the other information described in connection with Figure 3 to the house-

hold collector. All components in Figure 4 could then be eliminated. With this arrangement, the household collector microprocessor's storage would contain information on the room location of each television set and the identity of the rooms on either side of each passage. Based on this information, the household collector could instruct the appropriate monitoring device to display the prompts and store the responses. The household collector could also contain auto-dialer capability to place a call to the authorities when an unauthorised intrusion has been detected.

It will be appreciated that other means of detecting motion between rooms such as, for example, the installation of treadles or pads in the floor of each side or the passage may be used in place of the motion detectors described above. The light beams may also be replaced by lasers where suitable.

## Claims

1. Apparatus for monitoring the population in a room containing a device (112), said apparatus being characterised by comprising: detecting means (300) for detecting the entry and exit of people from said room; and monitoring means (410) for monitoring the status of said device (112), said monitoring means including prompting means (412) responsive to said detecting means (300) for prompting people in said room to input additional information to said monitoring means (410) when said detecting means detects entry or exit from said room.

2. Apparatus as claimed in claim 1 characterised in that said device is a video display means (112).

3. Apparatus as claimed in claim 1 or 2 characterised in that said detecting means (300) includes light emitters (204,206) and photocells (208,210) arranged on opposite sides of each passage to said room such that, in operation, said photocells receive uninterrupted beams of light from said light emitters, interruption of said beams of light indicating entry or exit from said room.

4. Apparatus as claimed in claim 3 characterised in that said light emitters (204,206, 204',206') and said photocells (208,210, 208',210') are arranged such that two beams of light, parallel to each other, cross each passage to said room at a first height, said beams of light at said first height being, in operation, interrupted by the entry or exit of a small child or an adult from said room, and another two beams of light, parallel to each other, cross each passage to said room at a second height, said second height chosen such that said beams of light at said second height are not, in

operation, interrupted by the entry or exit of a small child from said room, and said prompting means (412) being arranged to be actuated only when all of said beams are interrupted.

5 5. Apparatus as claimed in any preceding claim characterised in that said detecting means (300) is arranged to generate a gain signal when a person enters said room and generates a loss signal when a person exits said room.

10 6. Apparatus as claimed in claim 5 characterised in that said detecting means (300) includes means (404,406) for transmitting said gain signal and said loss signal over infrared frequencies to said monitoring means (410) when entry or exit from said room is detected, said monitoring means including memory means (414) for storing the time of day and said gain signal or said loss signal.

15 7. Apparatus as claimed in any preceding claim characterised by means (416) for manually inputting the identification of people in said room in response to said prompting means.

20 8. Apparatus as claimed in claim 5 or claim 6 or 7 when dependent thereon characterised in that said monitoring means (410) includes processing means (412) responsive to said detecting means (300) and sends an enable signal to said prompting means (412) when said detecting means detects entry or exit from said room and memory means (414) for storing the time of day and said gain signal or loss signal.

25 9. Apparatus as claimed in claim 8 characterised in that said memory means (414) of the device is arranged to store data representing the status of said device and to be controlled by said processing means (412) such that said gain signal or said loss signal is provided to said prompting means when said processing means sends said enable signal.

30 10. Apparatus as claimed in claim 8 or 9 characterised in that said prompting means (412) is arranged to generate a prompt on a video display screen of said device when said enable signal is received from said processing means.

35 11. Apparatus for collecting data from television viewers, including a plurality of remote units at a plurality of viewer locations, each of said remote units monitoring the population in a room containing a television receiver (112) and characterised by comprising: detecting means (300) for detecting the entry and exit of people from said room, said detecting means including light emitters (204,206) and photocells (208,210) arranged on opposite sides of each passage to said room such that said photocells, in operation, receive uninterrupted beams of light from said light emitters, the interruption of said beams of light by a person entering said room causing a gain signal to be generated, and the interruption of said beams of light by a

person exiting said room causing a loss signal to be generated; and video monitoring means (410) for monitoring the status of said television receiver, said video monitoring means including prompting means (412) responsive to said gain signal or said loss signal for generating a prompt requesting a user to input data including the identification of people in said room to said video monitoring means, said video monitoring means further comprising processing means, responsive to said gain signal or said loss signal, for sending an enable signal to said means for generating a prompt, and memory means (414) controlled by said processing means, for storing the time of day, said gain signal or said loss signal, and data representing the status of said television receiver, said memory means providing said gain signal or said loss signal to said means for generating a prompt when said processing means sends said enable signal.

20 12. Apparatus as claimed in claim 11 characterised in that said detecting means (300), in operation, transmits said gain signal and said loss signal over infrared frequencies to said monitoring means (410).

25 13. Apparatus as claimed in claim 11 or 12, characterised in that said light emitters (204,206, 204',206') and said photocells (208,210, 208',210') are arranged such that two beams of light, parallel to each other, cross each passage to said room at a first height, said beams of light at said first height being, in operation, interrupted by the entry or exit of a small child or an adult from said room, and another two beams of light, parallel to each other, cross each passage to said room at a second height, said second height chosen such that said beams of light at said second height are not, in operation, interrupted by the entry or exit of a small child from said room, said prompting means (412) being arranged so that a prompt is not generated when only said beams of light at said first height are interrupted, and said video monitoring means updates the status of said video display means to indicate that a small child has entered or exited said room when only said beams of light at said first height are interrupted.

40 14. Apparatus as claimed in any of claims 3, 4, 11, 12 or 13 characterised in that said detecting means (300) includes timing means (802) which is activated when at least one of said beams of light is interrupted, said timing means remaining activated until the beams of light are no longer interrupted or until a predetermined interval of time has passed, whichever first occurs, said timing means, in operation, producing a unique code when said predetermined interval has passed and the beams of light are still interrupted, said unique code indicating that a door across the passage to said room is closed.



15. Apparatus as claimed in any of claims 8 or 11 to 14 characterised in that said detecting means (300) contains a buffer memory (920,922) for each room on either side of a passage equipped with said detecting means, each buffer memory storing said gain signal or said loss signal, the contents of each buffer memory, in operation, being read by said monitoring means (410) at periodic intervals.

16. Apparatus as claimed in any preceding claim characterised by alarm means (328) connected to said detecting means, said alarm means being activated when at least one of said detecting means detects an unauthorised intrusion into said house.

17. Apparatus as claimed in any preceding claim characterised in that said monitoring means consists of a distributed monitoring system (Figure 10) for a house for monitoring the status of one or more television receivers in said house and monitoring with one or more of said detecting means the entry and exit of people from the rooms in said house.

18. Apparatus as claimed in claim 17 when dependent upon claim 2 characterised in that said distributed monitoring system includes processing means and memory means, said processing means coordinating data received from the or each detecting means (300) and the or each video display means and sending an enable signal to said prompting means (412) such that a prompt is generated for the or each video display means in a room of said house in which the or one of the detecting means has detected at least one of entry and exit of people, said memory means (414) storing the time of day and a gain signal or a loss signal which are generated by said detecting means when a person enters or exits a room of said house, respectively.

19. Apparatus as claimed in any of claims 17 or 18 characterised in that: said distributed monitoring system includes a household collector (1010) for coordinating data received from each of said detecting means and status data received from each of said television receivers, the status data from each of said television receivers being stored in a meter (1020,1030) corresponding to each television receiver, said household collector acquiring said status data from each meter at periodic intervals, and a prompt being generated for each television receiver in a room of said house in which said gain or said loss signal has been generated by one of said detecting means.

20. Apparatus as claimed in claim 8 or 11 or 18 or claim 19 when dependent upon claim 18 characterised in that, in operation, said processing means waits a predetermined interval of time after said memory means (414) has stored said gain signal or said loss signal and the time of day

before said processing means (412) sends said enable signal to said means for generating a prompt, said predetermined interval of time determined such that when said means for detecting generates said gain signal and said loss signal, or said loss signal and said gain signal, in rapid succession, no prompt will be generated.

21. Apparatus as claimed in any of claims 17 to 19 characterised by including a switched telephone network (1012) coupled to said distributed monitoring system and a central collector coupled to said network which includes a host computer system (1014) for gathering data collected by said distributed monitoring system.

22. A method of monitoring the population in a room containing a device (112), characterised by comprising the steps of: monitoring the status of said device; detecting the entry and exit of people from said room; and prompting people in said room to provide additional information when said detecting step detects entry or exit from said room.

23. A method as claimed in claim 22 characterised in that said device is a video display means (112).

24. A method as claimed in claim 22 or 23 characterised in that light emitters (204,206, 204',206') and photocells (208,210, 208',210') are arranged such that two beams of light, parallel to each other, cross each passage to said room such that said photocells receive uninterrupted beams of light from said light emitters at a first height, said beams of light at said first height being interrupted by the entry or exit of a small child or an adult from said room, and another two beams of light, parallel to each other, cross each passage to said room at a second height, said second height chosen such that said beams of light at said second height are not interrupted by the entry or exit of a small child from said room, said method further comprising the steps of generating a prompt when said beam of light at said first height and at said second height are approximately simultaneously interrupted; and updating the status of said device to indicate that a small child has entered or exited said room when only said beams of light at said first height are interrupted.

25. A method as claimed in any of claims 22 to 24 characterised in that said detecting step includes the steps of generating a gain signal when a person enters said room, generating a loss signal when a person exits said room, and storing a time of day and said gain signal or said loss signal.

26. A method as claimed in claim 25 characterised by including the step of reading data stored in said storing step at periodic intervals.

27. A method of collecting data from selected television viewers, said data including the identification of people in each room containing a tele-



vision receiver (112) characterised by comprising the steps of: detecting the entry and exit of people from each of said rooms with light emitters (204,206) and photocells (208,210) arranged on opposite sides of each passage to each of said rooms such that said photocells receive uninterrupted beams of light from said light emitters; generating a gain signal when at least one of said beams of light is interrupted by a person entering each of said rooms; generating a loss signal when at least one of said beams of light is interrupted by a person exiting each of said rooms; monitoring the status of said television receiver and receiving said gain signal and said loss signal; storing the time of day, said gain signal or said loss signal, and data representing the status of said television receiver; and generating a prompt requesting a user to input data including the identification of people in each of said rooms to said video monitoring means in response to said gain signal or said loss signal.

28. A method as claimed in claim 27 characterised in that said detecting step is performed with said light emitters (204,206, 204',206') and said photocells (208,210, 208',210') arranged such that two beams of light, parallel to each other, cross each passage to each of said rooms at a first height, said beams of light at said first height being interrupted by the entry or exit of a small child or an adult from each of said rooms, and another two beams of light, parallel to each other cross each passage to each of said rooms at a second height, said second height chosen such that said beams of light at said second height are not interrupted by the entry or exit of a small child from each of said rooms, said generating step generates said prompt when said beams of light at said first height and at said second height are approximately simultaneously interrupted, and said storing step includes the step of updating the status of said television receiver to indicate that a small child has entered or exited each of said rooms when only said beams of light at said first height are interrupted.

29. A method as claimed in any of claims 22 to 28 characterised by including the further steps of timing for interruption of at least one of said beams of light until the beams of light are no longer interrupted or until a predetermined interval of time has passed, whichever first occurs, and producing a unique code when said predetermined interval of time has passed and the beams of light are still interrupted, said unique code indicating that a door across the passage to each of said rooms is closed.

30. A method as claimed in any of claims 22 to 29 characterised by including the step of waiting a predetermined interval of time after storing the time of day and said gain signal or said loss signal before generating said prompt, said predetermined

interval of time determined such that when said means for detecting generates said gain signal and said loss signal, or said loss signal and said gain signal, in rapid succession, no prompt will be generated.

31. A method of monitoring the population in each room containing a television receiver (112) in a house, said house equipped with a distributed monitoring system for monitoring the status of at least one of said television receivers in said house and for monitoring the motion of people to or from each room containing a television receiver, characterised by comprising the steps of: detecting the entry and exit of people from each room containing a television receiver, with light emitters (204,206) and photocells (208,210) arranged on opposite sides of each passage to each of said rooms such that said photocells receive uninterrupted beams of light from said light emitters; generating a gain signal when at least one of said beams of light is interrupted by a person entering said room; generating a loss signal when at least one of said beams of light is interrupted by a person exiting said room; transmitting said gain signal or said loss signal at periodic intervals; storing said gain signal or said loss signal transmitted in said transmitting step; determining if an alarm means (928) is activated; initiating an alarm if said alarm means is activated and said gain signal or said loss signal has been received; determining if a gain signal and a loss signal or a loss signal and a gain signal were received from one of said rooms in rapid succession when said alarm means was not activated; for each television receiver in said house, determining if said television receiver is activated; determining if said detecting steps detects an adult or a child; and generating a prompt on said television receiver when the entry or exit or any adult from the room containing said television is detected, said television receiver is determined to be activated and said signals are not determined as being generated in rapid succession, said prompt requesting that data representing the population of people in the room be inputted.

32. A method of monitoring the population in each of a plurality of rooms containing a video display means, characterised by comprising the steps of: a) detecting the entry and exit of people from each of said rooms; b) monitoring the status of at least one of said video display means; c) monitoring said detecting step a) and said status monitoring step b) from a central location in said house; and d) generating, in response to said monitoring step c) determining that at least one of entry and exit has occurred in one of said rooms with said video display means activated, a prompt for said video display means in said one of said rooms.

33. A method as claimed in any of claims 22 to 32 characterised by including the further step of generating an alarm when said detecting step detects an intrusion into one of said rooms and said alarm is activated.

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34. A method as claimed in claim 32 or 33 characterised by including the further step of transmitting data collected at said central location to a host computer system.

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FIG. 1

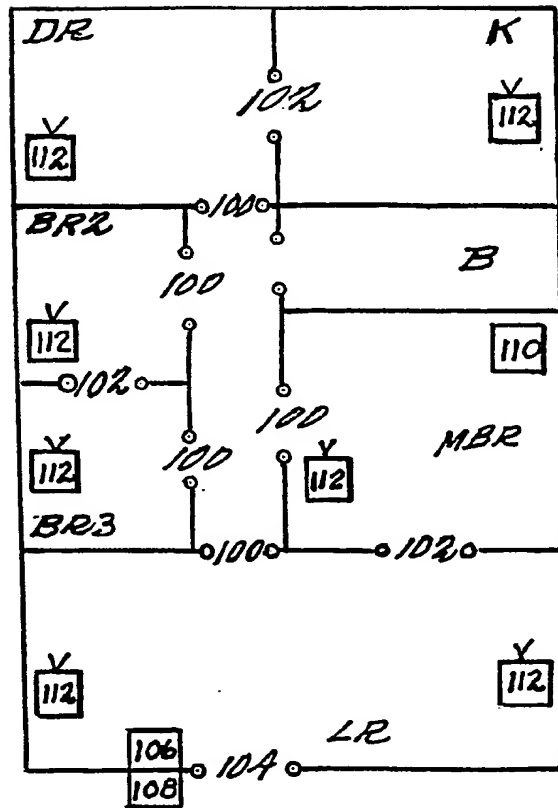


FIG. 2

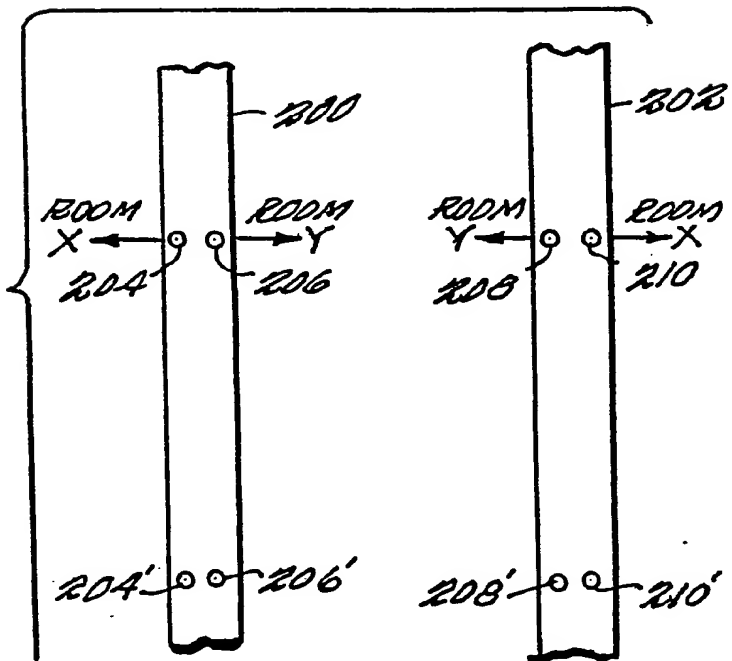


FIG. 3

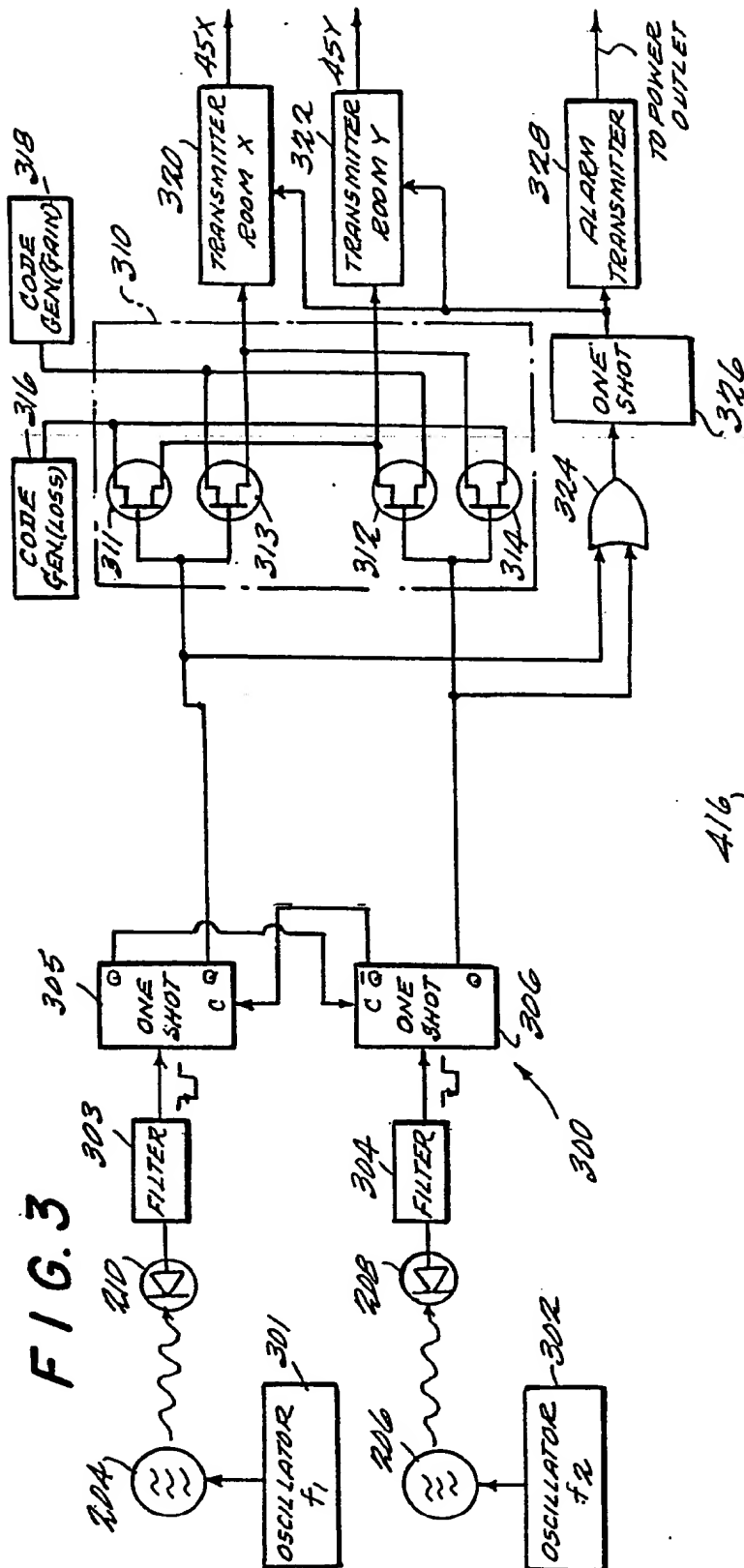


FIG. 4

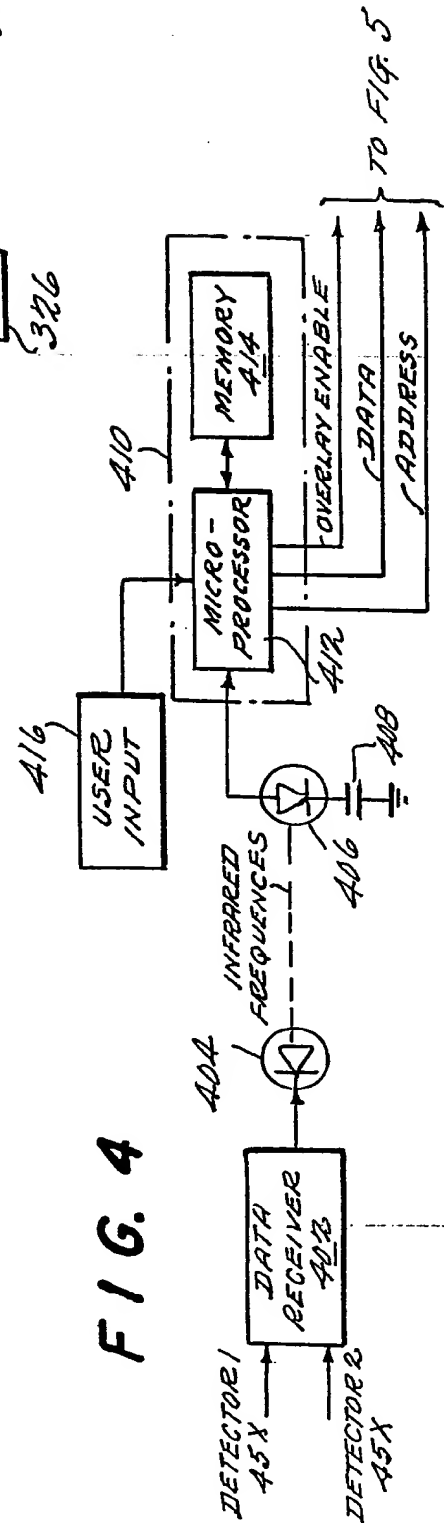


FIG. 5

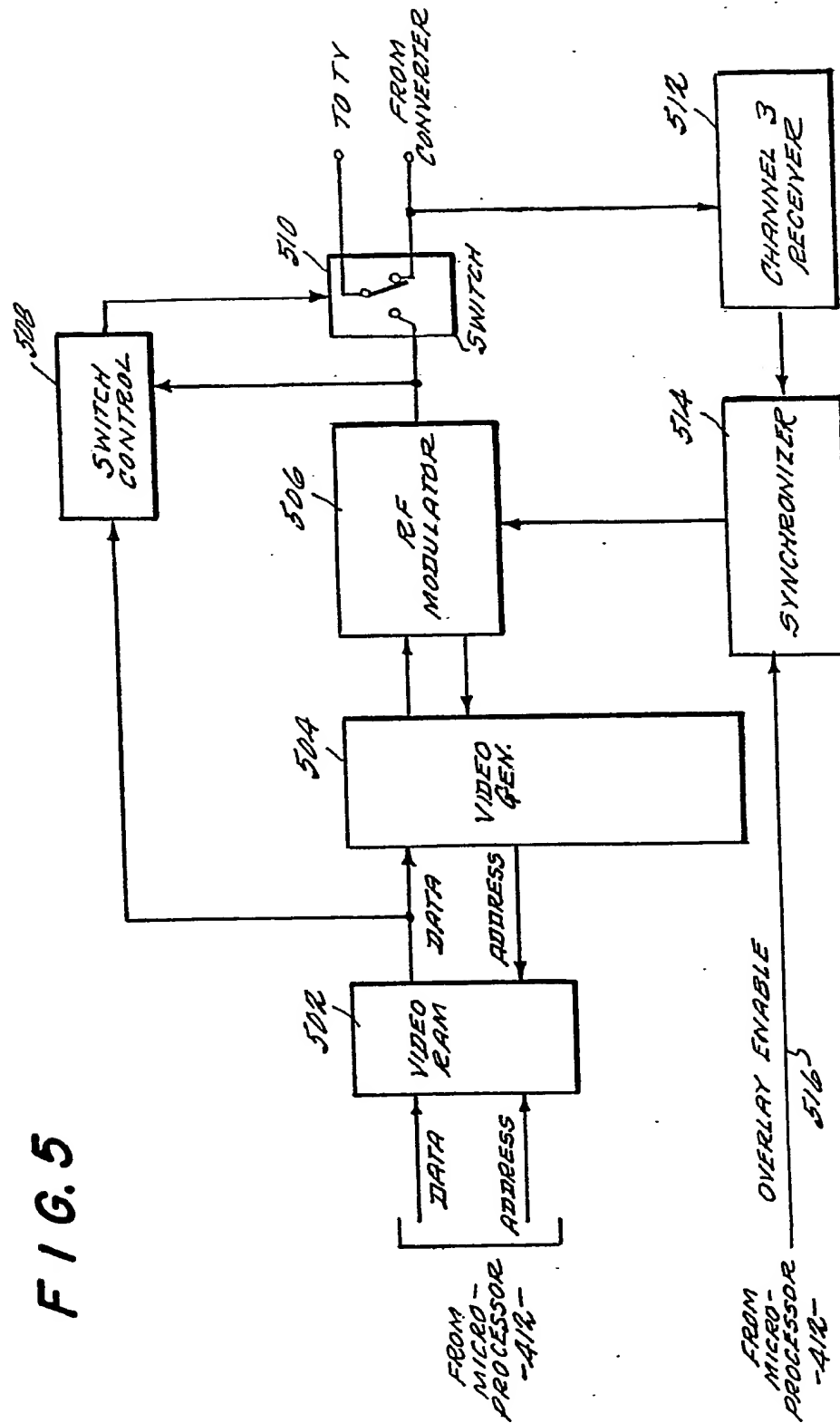
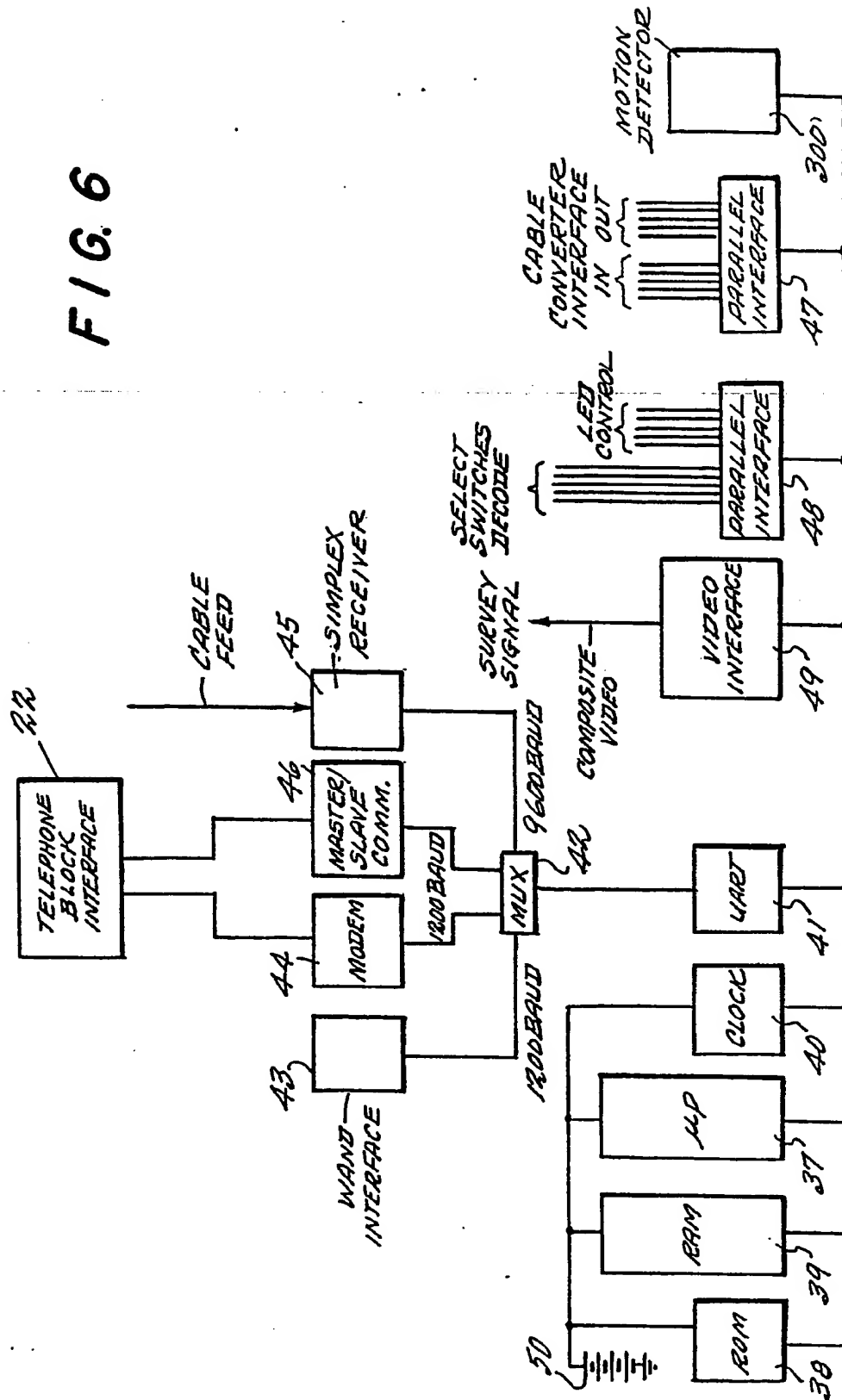


FIG. 6



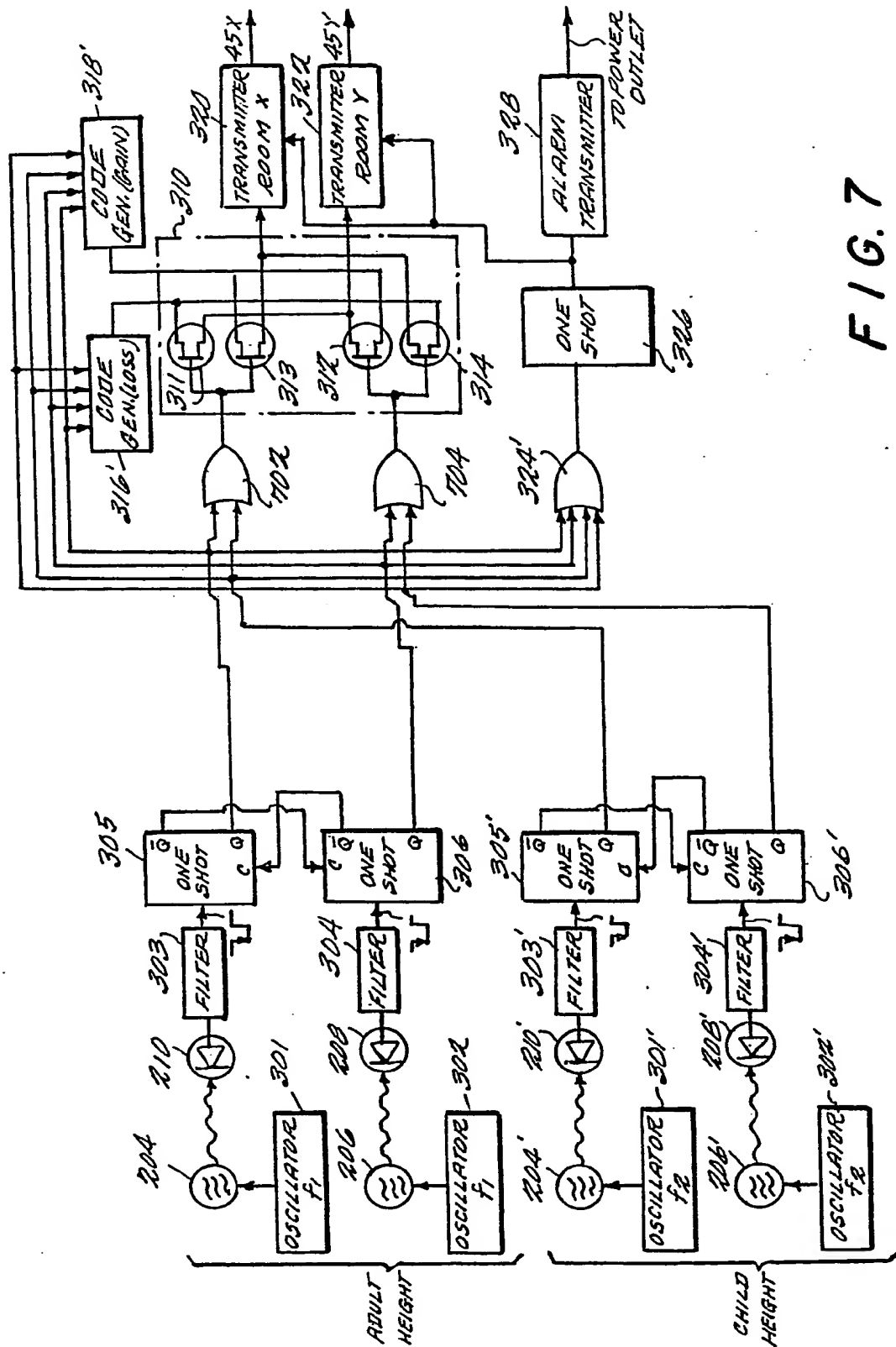


FIG. 7



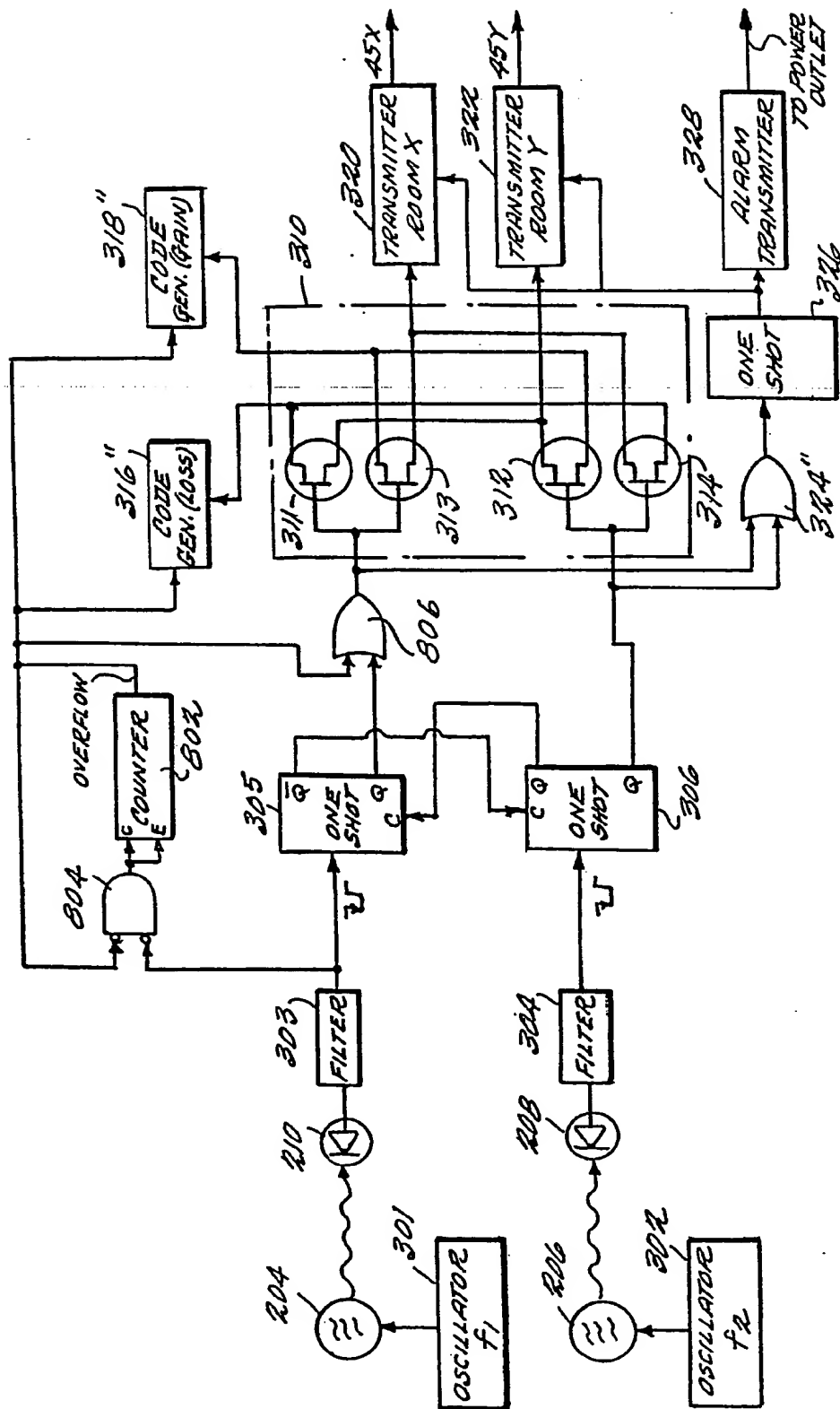


FIG. 8

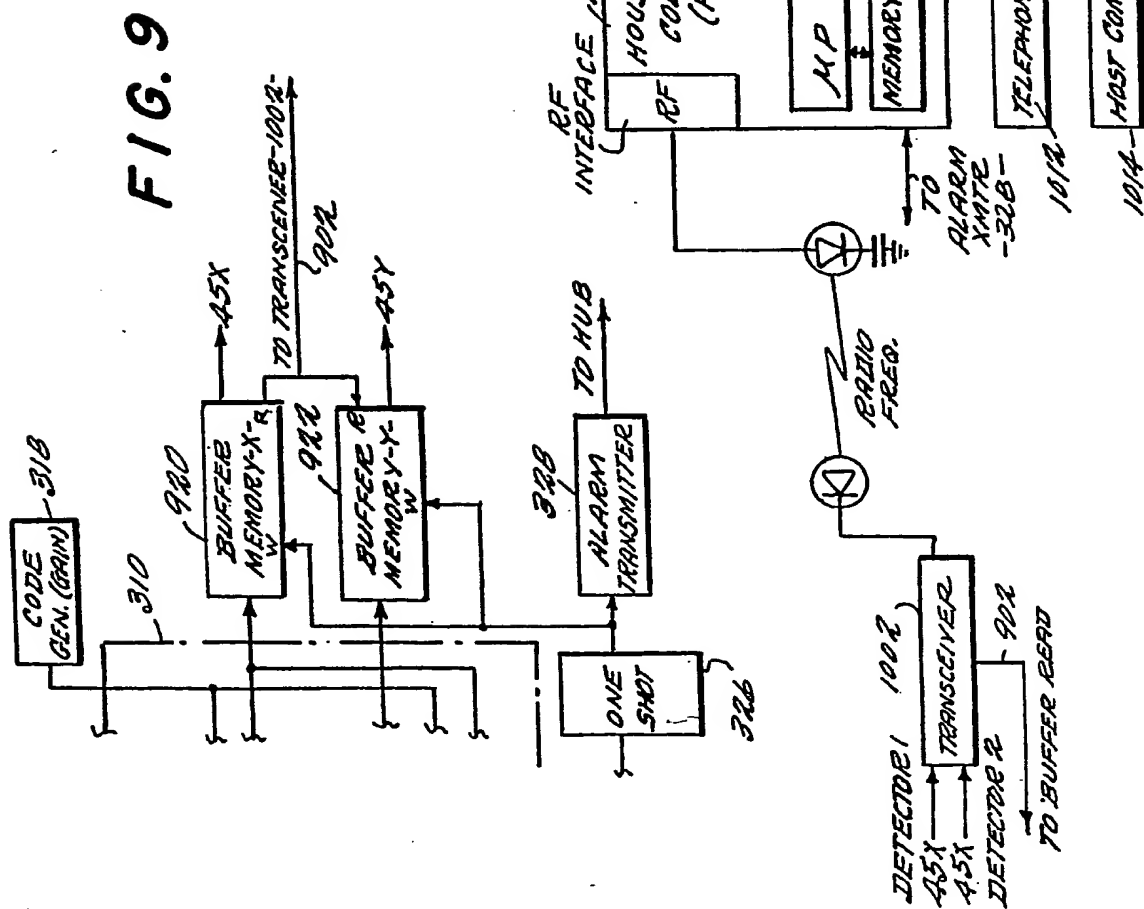
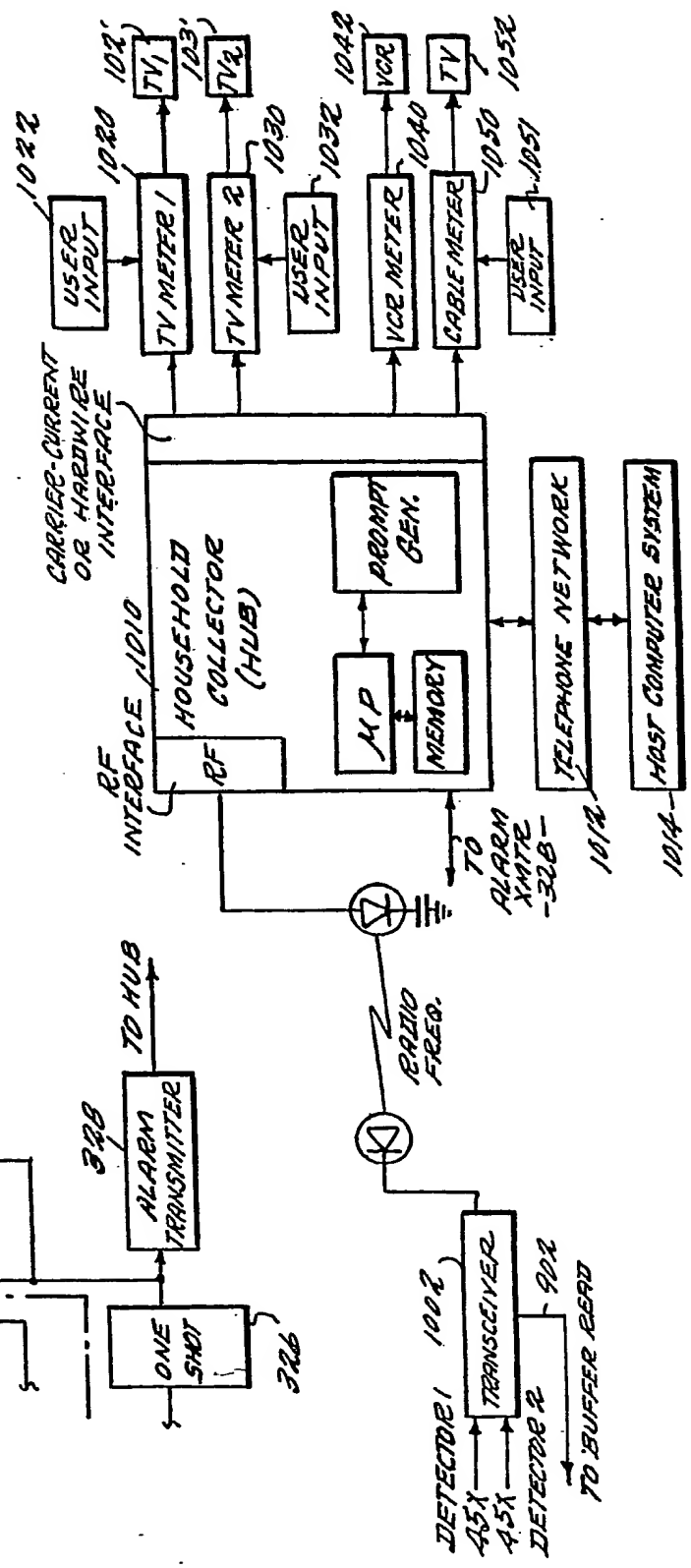
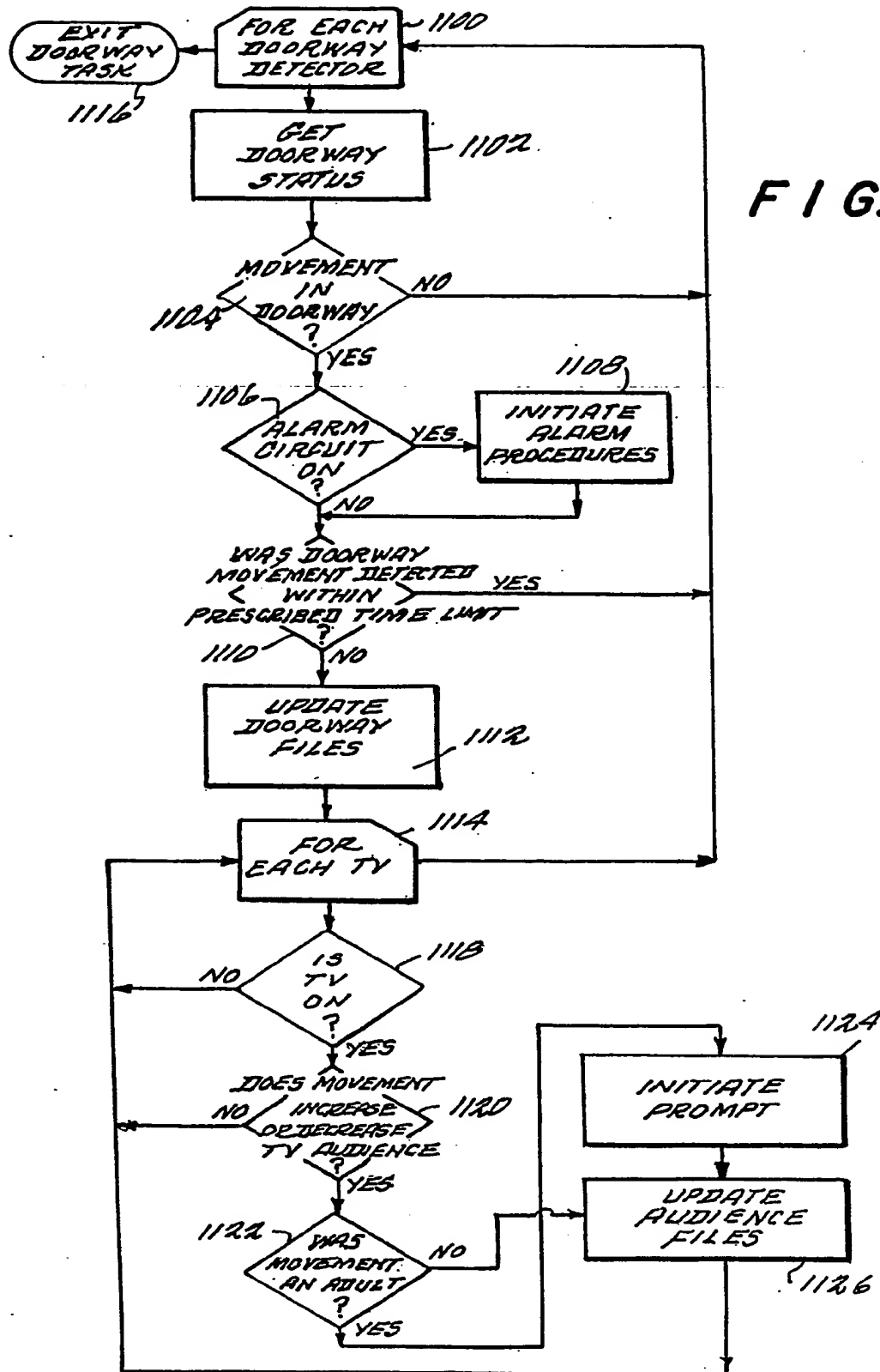


FIG. 10





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**EUROPEAN PATENT APPLICATION**

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51 Int. Cl.<sup>5</sup>: H04H 9/00

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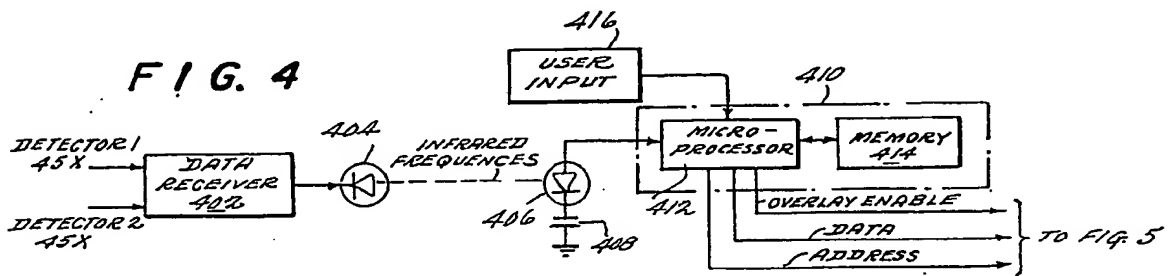
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54 **Method of and apparatus for monitoring a population in a room and for collecting data from television viewers.**

57 Apparatus for monitoring the population in a room containing a device (112), the apparatus comprises a detector (300) for detecting the entry and exit of people from the room, and a monitor (410) for monitoring the status of the device (112). The monitor includes a prompting circuit (412) responsive to the detector (300) for prompting people in the room to input additional information to the monitor (410) when the detector detects entry or exit from the room.



EP 0 262 757 A3



European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number

EP 87 30 5743

| DOCUMENTS CONSIDERED TO BE RELEVANT   |  |  |  |
|---|--|--|--|
| Category  | Citation of document with indication, where appropriate, of relevant passages  | Relevant to claim                              | CLASSIFICATION OF THE APPLICATION (Int. Cl. 4) |
| D,A   | EP-A-0 144 085 (PEAC TECHNOLOGIES INC.)<br>* Page 5, lines 19-25; page 11, lines 1-11; page 51, lines 13-18; figures 1-2 * | 1,6,8, 15,32                                   | H 04 H 9/00                                    |
| D,A   | * Page 7, lines 27-29; figure 5 *  | 19   |  |
| D,A   | * Page 11, lines 18-29; figure 1 *   | 21,34  |  |
| A   | GB-A-2 146 152 (AGB RESEARCH plc)<br>* Page 2, lines 25-59; figure 5 *   | 1-4,7  |  |
| A   | GB-A-2 140 947 (AGB RESEARCH plc)<br>* Page 4, line 93 - page 5, line 28 *   | 21   |  |
| A   | EP-A-0 128 481 (ADTEL PRODUCTS INC.)<br>* Page 7, lines 2-6; page 8, lines 30-35; figure 1 *                               | 21   |  |
| The present search report has been drawn up for all claims  |  |  | TECHNICAL FIELDS SEARCHED (Int. Cl. 4)         |
|   |  |  | H 04 H   |
| Place of search<br>THE HAGUE  |  | Date of completion of the search<br>18-12-1989 | Examiner<br>ZANTI P.V.L.                       |
| <b>CATEGORY OF CITED DOCUMENTS</b><br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |  |  |  |

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